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II. Solution by G. B. M. ZERR, A. M., Ph. D., Professor of Mathematics and Science, Chester High School, Chester, Pa.

Let A, B, C, D be the given points.

Join AS, BS, CE, DS. Then $AB:BC=AD:DC$, or $AB:AD=BC:DC$.

$\therefore \triangle ASB:\triangle BSC=\triangle ASD:\triangle CSD$.

$\therefore AS.BS\sin ASB:BS.CS\sin BSC=AS.DS\sin ASD:CS.DS\sin DSC$.

$$\therefore \frac{\sin ASB}{\sin BSC}=\frac{\sin ASD}{\sin DSC}.$$

But $\sin ASB=\sin(\frac{1}{2}\pi-BSC)=\cos BSC$.

$\sin ASD=\sin(\frac{1}{2}\pi+DSC)=\cos DSC$.

$\therefore \cot BSC=\cot DSC$.

$\therefore \angle BSC=\angle DSC$.

$\therefore$ C bisects arc FCE. Similarly A bisects arc $EASF$.

CALCULUS.

80. Proposed by B. F. FINKEL, A.M., M.Sc., Professor of Mathematics and Physics, Drury College, Springfield, Mo.

A vessel is anchored in three fathoms of water, and the cable passes over a sheave in the bowsprit, which is six feet above the water. If the cable is hauled in at the rate of one foot a second, how fast is the vessel moving through the water when there is five fathoms of cable out? What is the acceleration of the vessel's velocity? [From *Byerly's Problems in Differential Calculus.*] Ans.—(a) 5-6 feet per second; (b) 12-121 feet per second. Are these results correct?

I. Solution by C. HORNUNG, A. M., Professor of Mathematics, Heidelberg University, Tiffin, Ohio

Let x=the horizontal distance from sheave to anchor, and y=the length of cable out, both in feet.

Then $x=(y^2-576)^{\frac{1}{2}}$. Differentiating and making $y=30$ and $dy=-1$, we find $dx=-\frac{5}{3}$; that is, x *diminishes* at the rate of $\frac{5}{3}$ ft. per second, or the ship moves at the same rate. Differentiating again and making the same substitutions we get $d^2x=-\frac{8}{81}$, that is, the vessel's velocity is increasing at the rate $\frac{8}{81}$ ft. per second.

Accordingly the results given as answers to the problem are not correct. It is evident without a solution that the vessel's velocity is always *greater* than the rate at which the cable is hauled in.

II. Solution by ELMER SCHUYLER, High Bridge, N. J.

If I understand the problem, it is (1) $y^2=x^2+24^2$.

We want to find $dx/dt=v$, and $d^2x/dt^2=\alpha$. (2) $y/t=1$.

$\therefore y=t$; $dy=dt$.

$dy/dt=1$, *i. e.* rate is constant and has no acceleration.

$$(3)\ 2x\frac{dx}{dt}=2y\frac{dy}{dt}.$$

$$(4)\ \frac{dx}{dt}=\frac{y}{x}\cdot\frac{dy}{dt}=\frac{30}{\sqrt{30^2-24^2}}\times 1=\tfrac{5}{3}\text{ ft.}\quad\text{1st answer.}$$

$$(5)\ \frac{d^2x}{dt^2}=\frac{x(dy/dt)(=\text{constant }1)-y(dx/dt)}{x^2}=\frac{x-(y^2/x)}{x^2}=\frac{x^2-y^2}{x^3}$$

$$=-\frac{24^2}{x^3}=-\frac{24^2}{18^3}=-\tfrac{8}{81}\text{ acceleration per second.}$$

III. Results by J. SCHEFFER, A. M., Hagerstown, Md.

If I understand the problem correctly, I find the values to be $\frac{5}{3}$ and $\frac{8}{81}$ instead of $\frac{5}{6}$ and $\frac{12}{121}$.

[NOTE.—A letter from Dr. Byerly states that this, as a number of other errors, crept into the work by oversight. EDITOR.]

MECHANICS.

63. Proposed by A. H. BELL, Hillsboro, Ill.

From a horizontal support at a distance of 10 feet apart, a beam 5 feet long and 10 pounds weight is suspended by ropes attached to each end. The ropes are 3 and 5 feet respectively, in length. Required the angles made by the ropes and horizontal support. Also the stress upon each rope.

Comment by G. B. M. ZERR, A. M., Ph. D., Professor of Mathematics and Science, Chester High School, Chester, Pa.

Soon after my solution of the above problem was published Mr. George Richards and Mr. A. H. Bell called my attention to the incorrectness of my assumption in regard to the angles. The error was due to carelessness or inability on my part, either of which is inexcusable. Mr. A. H. Bell sent me the following admirable solution, and I doubt whether a simpler one can be effected. The fact that Mr. Bell has solved this problem is a sure guarantee of its correctness and accuracy.

Let $AB=c=10$, $AD=3=d$, $DC=g=5$, $BC=e=5$, $EB=x+y$, $AE=x-y$.

$$\cos E=\frac{(x+y)^2+(x-y)^2-c^2}{2(x+y)(x-y)}=\frac{(x+y-e)^2+(x-y-d)^2-g^2}{2(x+y-e)(x-y-d)}\ldots\ldots\ldots\ldots\ldots(1).$$

$$DF=CN=\frac{c^2+(x-y)^2-(x+y)^2}{2c(x-y)}(x-y-d)=\frac{c^2+(x+y)^2-(x-y)^2}{2c(x+y)}(x+y-e).(2).$$

$e+d=a=8$, $e-d=b=2$.

$$\therefore\ (1)=(4by+g^2-c^2-b^2)x^2-a(4y^2-c^2)x+(c^2+a^2-g^2)y^2-bc^2y$$

$$-\tfrac{1}{4}c^2(a^2-b^2)=0,\text{ or }x^2-\frac{32(y^2-25)}{8y-79}+\frac{139y^2-200y-1500}{8y-79}=0\ldots(3).$$